reconsideration of the subject application, particularly in view of the following remarks.

The invention claimed by Applicants is *a polymer electrolyte membrane fuel cell stack* comprising a plurality of *substantially planar* fuel cell units, each of which comprises an anode electrode, a cathode electrode and a polymer electrolyte membrane disposed between the anode electrode and the cathode electrode. A metal bipolar plate is disposed between the anode electrode of one fuel cell unit and the cathode electrode of an adjacent fuel cell unit in the fuel cell stack. The metal bipolar plate comprises a chromium-nickel *austenitic* alloy having *a nitrogen content of zero*, wherein the chromium and the nickel, on a combined basis, comprise at least about 50% by weight of the alloy.

**Response to Examiner's Arguments**

In response to the previous Office Action mailed 02 December 2005, Applicants argued that the primary reference relied upon by the Examiner for rejection of the subject application, U.S. Patent 6,300,001 B1 to Hornung et al. (hereinafter "the Hornung et al. patent"), does not teach or suggest a metal bipolar plate comprising an austenitic alloy. The basis for this argument was that the term "austenitic" is nowhere to be found in the reference and that it is the structure of the stainless steel that determines its classification among five different classifications -

ferritic, martensitic, austenitic, duplex, and precipitation-hardening - and not its composition. In response to Applicants' arguments, the Examiner has argued that there is a one-to-one correspondence between the structure of a stainless steel and its alloy type from which it follows that knowing the composition of the stainless steel allows a determination of the classification of the stainless steel. In support of this argument, the Examiner cites the ASM Specialty Handbook as stating that the face-centered cubic (fcc) structure characterizing austenitic stainless steels is attained through the liberal use of austenitizing elements such as nickel, manganese and nitrogen. Thus, Applicants understand the Examiner's argument to be that if the prior art teaches a stainless steel composition that overlaps the composition of the stainless steel identified by Applicants as being austenitic, then, notwithstanding that there is no mention of the term "austenitic" in the reference, the classification is inherently taught. Applicants respectfully disagree.

Applicants are enclosing herewith a listing of the chemical composition limits for the stainless steels comprising the five different classifications taken from The Making, Shaping and Treating of Steel, 10th edition, pp. 1334-5, 1985. The Examiner has indicated that the presence of nickel, manganese and/or nitrogen in the composition of a stainless steel inherently constitutes the classification of the stainless steel as austenitic. However, *stainless steels classified as precipitation hardenable*

*also contain substantial amounts of both manganese (up to about 1%) and nickel (3.0-8.5%).* If one accepts the Examiner's argument, based upon the presence of manganese and/or nickel, these stainless steels should be classified as austenitic, and yet they are not. In addition, the Hornung et al. patent, in the table extending from Col. 1, line 61 to Col. 2, line 8, lists stainless steel compositions having 2.25 - 40.5 wt. % nickel and 0 - 13 wt. % manganese. *Clearly within these ranges are stainless steel compositions which include both nickel and manganese but which are not austenitic.* Thus, Applicants respectfully urge that, *without a specific reference to a bipolar plate comprising an austenitic stainless steel, the Hornung et al. patent does not anticipate the invention claimed by Applicants* in the manner required by 35 U.S.C. 102(e).

Applicants further respectfully urge that, even if it is the composition of the stainless steel that defines the stainless steel as being austenitic as argued by the Examiner, the Hornung et al. patent does not teach a bipolar plate comprising an austenitic stainless steel as claimed by Applicants. The Hornung et al. patent, beginning at Col. 1, line 53 states:

> "The subject matter of the invention is a fuel cell that comprises a membrane electrode unit, two current collectors and,or (sic) a cell frame and/or a bipolar plate, whereby the material of at least one of the *solid constructive parts* (emphasis added) is made of an Fe-based material selected from the alloys with the following compositions:

| | |
|---|---|
| C content: | 0-0.6 weight % |
| Si content: | 0-2 weight % |
| Cr content: | 8.25-46.5 weight % |
| Mo content: | 1.25-14.0 weight % |
| Ni content: | 2.25-40.5 weight % |
| Cu content: | 0-4.0 weight % |
| Mn content: | 0-13 weight % |
| N content: | 0.02-1 weight % |
| Nb content: | 0-0.5 weight % |
| P content: | 0-0.09 weight % |
| S content: | 0-0.06 weight % |
| Fe content: | remainder to 100 weight % |

"

Beginning at Col. 2, line 57, the Hornung et al. patent defines the term "solid constructive part" as being cell frames, current collectors and/or collector plates, bipolar plates, terminating and/or pole plates, or some other constructive part, such as a frame element that is usefully constructed from a material whose shape is stable under normal conditions. Thus, the Hornung et al. patent teaches that at least one of these solid constructive parts is made from an alloy having a composition as listed above. It should also be appreciated that the compositions listed in the Hornung et al. patent are extremely broad and that *no specific examples associating compositions with bipolar plates are set forth therein.*

The basis for anticipatory rejection of the claims by the Examiner is the broadest ranges of components content taught by the Hornung et al. patent. However, *the mere teaching of an overlapping range by the prior art is not, by itself, necessarily*

*determinative of the issue.* MPEP §2131.03 states that *when the prior art discloses a range which touches, overlaps or is otherwise within the claimed range, but no specific examples falling within the claimed range are disclosed,* ***such teachings do not constitute prima facie anticipation.*** Rather anticipation is to be determined on a case by case basis. In *In re Petering*, 301 F.2nd 676, 682, 133 USPQ 275, 280 (CCPA 1962), the court found that claims to a titanium (Ti) alloy with 0.6-0.9% nickel (Ni) and 0.2-0.5% molybdenum (Mo) were anticipated by a graph in a Russian publication on Ti-Ni-Mo alloys because the graph contained *an actual data point* corresponding to a Ti alloy containing 0.25% Mo and 0.75% Ni, and this composition was within the claimed range of compositions. *Such is not the case with the teachings of the Hornung et al. patent.* That is, ***there are no specific exemplary compositions for a bipolar plate set forth in the Hornung et al. patent.*** Absent such a specific example, in accordance with MPEP §2131.03, Applicants respectfully urge that the invention claimed by Applicants is not anticipated by the Hornung et al. patent in the manner required by 35 U.S.C. 102(e).

Regarding the lack of specificity by the Hornung et al. patent as to the use of an alloy comprising a combined Cr-Ni content greater than 50%, a fact which the Examiner does not dispute, the Examiner nevertheless argues that motivation for the skilled artisan (*by way of specific example*) (emphasis added) to focus on weight

percentages at the top of the "preferred" range (46.5 and 40.5 wt. %, respectively) and to explore weight percentages above that range is provided. Applicants have carefully studied the Hornung et al. patent and can find *no specific example* set forth therein as alluded to by the Examiner that would motivate one skilled in the art to focus on weight percentages at the top end of the "preferred" range. Moreover, as previously argued by Applicants, *the highest Ni content set forth by way of example or description of preferred embodiments in the Hornung et al. patent is 26% by weight.* In addition, the trend *in all* of the preferred embodiments cited by the Hornung et al. patent is *in the direction of alloys comprising less than 26% by weight Ni*, a teaching *away from* the invention claimed by Applicants.

According to the above cited section of the MPEP, in order to anticipate the claims, the claimed subject matter must be disclosed in the prior art with "sufficient specificity to constitute an anticipation under the statute." A determination of "sufficient specificity" is fact dependent. Applicants respectfully urge that *the teachings of the Hornung et al. patent lack the "sufficient specificity" required to constitute an anticipation under the statute.* Applicants note that the combined Cr-Ni content of the preferred embodiments of the Hornung et al. alloy is less than the minimum 50% combined Cr-Ni content claimed by Applicants. Nowhere does the Hornung et al. patent teach or suggest *with any specificity* the use of an alloy in a

bipolar plate as claimed by Applicants comprising a combined Cr-Ni content of greater than 50%. *Nor is there any hint or suggestion by the Hornung et al. patent of any benefits or other motivations for employing alloys having a Ni content greater than 26% in a bipolar plate. In contrast thereto, such a benefit has been discovered and described by Applicants in the subject application, namely that increasing the amount of nickel in the stainless steel bipolar plate reduces the amount of Cr corrosion* (page 7, lines 6-7).

The Examiner further argues that modifications in composition are motivated by a desire to facilitate production. While this may, indeed, be the case, such a motivation, by itself, provides no motivation as to the changes in composition required to achieve the desired production facilitation. For example, as discussed at paragraph [0017] of the subject application, *nitrogen is conventionally used in austenitic alloys to enhance the strength of the alloy and to prevent corrosion and pitting of the alloy.* However, the consequence of enhancing the strength of the alloy by the addition of nitrogen thereto is a reduction in the formability of the alloy. Thus, changes in nitrogen content of austenitic stainless steel alloys affect competing alloy characteristics. That is, *reducing the nitrogen content of the austenitic alloy to zero as claimed by Applicants for the benefit of enhancing formability of the alloy negatively impacts the strength of the austenitic alloy and the resistance of the alloy*

*to corrosion and pitting.* Nowhere is there any guidance by the Hornung et al. patent as to how to address such competing alloy characteristics. Moreover, Applicants respectfully urge that it is surprising and unexpected that the bi-polar separator plate of the invention claimed by Applicants exhibits superior resistance to corrosion and pitting in the acid reducing environment of the polymer electrolyte membrane fuel cell stack in spite of having a nitrogen content of zero. Applicants respectfully urge that the Hornung et al. patent neither teaches nor suggests a bipolar separator plate constructed of a metal alloy, much less an austenitic stainless steel alloy, having a nitrogen content of zero.

Regarding the Examiner's interpretation of 0.02 wt. % of nitrogen as taught by the Hornung et al. patent as being readable on the zero amount of nitrogen claimed by Applicants, the Examiner argues that interpreting a 0.02 wt. % of nitrogen as being readable on Applicants' claimed zero amount is considered reasonable on the basis that a zero amount of nitrogen has a zero amount of significant figures. Applicants respectfully disagree. The Hornung et al. patent teaches an alloy comprising no less than 0.02 wt. % nitrogen. Applicants urge that even such a small amount of nitrogen must be considered to have an affect on the composition. To suggest that such an alloy having such a small amount of nitrogen is equivalent to an alloy having no nitrogen (a zero amount of nitrogen) would clearly be contrary to the

teachings of the Hornung et al. patent. Otherwise, the Hornung et al. patent would have taught an alloy composition having no nitrogen. That is, the Hornung et al. patent considers 0.02 wt. % nitrogen to be significant. Thus, *Applicants respectfully urge that the Hornung et al. patent suggests that an alloy composition having no nitrogen, as claimed by Applicants, is different from an alloy composition having 0.02 wt. % nitrogen.*

The Examiner also argues that a "zero amount" as claimed by Applicants is not even a number *per se.* Applicants respectfully urge that it is well understood that a composition having a zero amount of nitrogen is a composition having no nitrogen. Accordingly, Applicants respectfully urge that, because the Hornung et al. patent teaches that 0.02 wt. % nitrogen in an alloy composition is significant to the performance of the alloy, the Hornung et al. patent cannot be interpreted to suggest that an alloy composition having no nitrogen is equivalent to one having a 0.02 wt. % nitrogen.

Claims 9 and 11 have been rejected under 35 U.S.C. 103(a) as being unpatentable over the Hornung et al. patent in view of Koncar et al., U.S. Patent 5,942,247 (hereinafter "the Koncar et al. patent"). This rejection is respectfully traversed. Applicants' arguments with respect to the Hornung et al. patent as set forth herein above are equally applicable to this rejection and, thus, will not be repeated.

The Koncar et al. patent is relied upon by the Examiner as teaching a polymer electrolyte membrane fuel cell stack employing graphite bipolar plates, based upon which the Examiner argues that it would have been obvious to one of ordinary skill in the art to utilize a graphite bipolar plate in the apparatus of the Hornung et al. patent to arrive at the invention claimed by Applicants. Applicants respectfully urge, however, that the use of a graphite bipolar plate in the apparatus of the Hornung et al. patent would not result in the invention claimed by Applicants because the Hornung et al. patent neither teaches nor suggests a polymer electrolyte membrane fuel cell stack having current collectors constructed of austenitic stainless steel alloys as claimed by Applicants. Accordingly, Applicants respectfully urge that the Hornung et al. patent and the Koncar et al. patent, alone or in combination, do not render Applicants' claimed invention obvious in the manner required by 35 U.S.C. 103(a).

Claims 1-17 have been rejected on the ground of non-statutory obviousness-type double patenting as being unpatentable over Claims 1-15 of U.S. Patent 6,723,462 (hereinafter "the '462 patent") in view of Kanter, U.S. Patent 3,754,899 (hereinafter "the Kanter patent"). This rejection is respectfully traversed. The '462 patent claims a polymer electrolyte membrane fuel cell stack having a bipolar separator plate and/or current collector made of a chromium-nickel austenitic stainless steel alloy with chromium and nickel combined comprising at least about

50% by weight of the alloy and with nickel comprising greater than 32% by weight of the alloy. Nowhere does the '462 patent teach or suggest a polymer electrolyte membrane fuel cell stack having a bipolar separator plate and/or current collector made of a chromium-nickel austenitic stainless steel alloy with chromium and nickel combined comprising at least about 50% by weight of the alloy *and having zero nitrogen content* as required by Applicants' claimed invention. The Kanter patent teaches austenitic *iron-based* alloys for use *at elevated temperatures above about 1000°F* comprising chromium, nickel and boron (Col. 1, lines 5-19 and lines 63-68). The alloys are indicated to be substantially free of nitrogen, based upon which the Examiner argues that it would be obvious to modify the apparatus of the '462 patent by ensuring a zero amount of nitrogen in the austenitic stainless steel employed in the bipolar plate to arrive at the invention claimed by Applicants. The motivation for such a modification is indicated by the Examiner to be to stabilize the alloy at elevated temperatures. Applicants respectfully disagree.

Col. 1, lines 63-68 of the Kanter patent states:

> "It is an object, therefore, of the present invention to provide austenitic iron base alloys *having high temperature stability* (emphasis added), particularly to austenitic iron base alloys having improved stability or sensitization, *at temperatures in the range of about 1000°F* (emphasis added), and to provide processes for the manufacturing of the same."

As previously argued by Applicants in response to the previous Office Action, it is well known to those skilled in the art that polymer electrolyte membrane fuel cells operate at temperatures less than about 160°C (320°F). Thus, an austenitic stainless steel which is able to withstand temperatures of greater than 1000°F as taught by the Kanter patent *is not* an issue for austenitic stainless steel alloys employed in polymer electrolyte membrane fuel cells. Accordingly, Applicants respectfully urge that, based upon the teachings of the Kanter patent, there would be no motivation for one skilled in the art to modify the austenitic stainless steel of the bipolar plate of the '462 patent to provide a nitrogen content of zero as claimed by Applicants because the Kanter patent neither teaches nor suggests that such a modification would provide any benefit in the substantially lower operating temperature regime of the polymer electrolyte membrane fuel cell.

The Examiner does not dispute the fact that the ability of an austenitic stainless steel to withstand temperatures of greater than 1000°F as taught by the Kanter patent *is not* an issue for austenitic stainless steel alloys employed in the significantly lower operating temperature polymer electrolyte membrane fuel cells. Rather, the Examiner has argued that this argument by Applicants is not persuasive because the temperature disclosed by the Kanter patent is a temperature of manufacturing during the alloying process. However, as clearly seen from the above

recited portion of the specification of the Kanter patent, the 1000°F temperature disclosed by the Kanter patent is clearly an operating temperature and not a manufacturing temperature as posited by the Examiner. Accordingly, Applicants respectfully urge that the '462 patent and the Kanter patent, alone or in combination, do not render Applicants' claimed invention obvious.

**Conclusion**

Applicants intend to be fully responsive to the outstanding Office Action. If the Examiner detects any issue which the Examiner believes Applicants have not addressed in this response, Applicants urge the Examiner to contact the undersigned.

Applicants sincerely believe that this patent application is now in condition for allowance and, thus, respectfully request early allowance.

Respectfully submitted,

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